

## The avifauna of Kofiau Island, Indonesia

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**SUMMARY.**—Kofiau is an island of 144 km<sup>2</sup> lying among the Western Papuan Islands 30 km west of the New Guinea continental shelf. Although it supports two endemic allospecies and three subspecies of birds discovered during brief earlier surveys, it has remained ornithologically the most under-surveyed significant island of the Papuan Region. In three visits we increased Kofiau's known avifauna from 29 to 78 species. Its avifaunal species composition is typical of the Papuan Region's oceanic islands, in lacking bird species that do not fly across water and hence are confined to New Guinea and the larger continental islands of the New Guinea shelf. The avifauna is convergently similar to that of Bismarck islands east of New Guinea, similarly founded by over-water colonisation. The Western Papuan Islands support ten species of avian supertramps, i.e. species characteristic of species-poor small and / or remote islands. More colonists reached Kofiau from New Guinea than from Wallacea. We discuss the relationship of Kofiau to Lydekker's Line, the eastern equivalent of the much more famous Wallace's Line that forms the western boundary of Wallacea. We report the first field observations of Kofiau's five endemics, and of three Kofiau populations constituting first or second records for the Papuan Region.

The year 2009 is being marked by many celebrations to recognise the 150th anniversary of publication of Darwin's *On the origin of species* in 1859. As the first detailed exposition of evolution and natural selection, Darwin's book founded the science of evolutionary biology and is widely considered the greatest single advance in the history of biology. Few celebrations recognise Alfred Russel Wallace, who in the previous year had independently conceived and published simultaneously with Darwin a brief account of evolution and natural selection (Wallace 1858). Wallace's two books *The geographic distribution of animals* (1876) and *Island life* (1880) founded the science of biogeography.

Our paper contributes to honouring Wallace through an account of the birds of Kofiau Island, lying in what Wallace termed the Malay Archipelago (the island zone between the South-East Asian mainland and New Guinea). The eight years that Wallace spent collecting in the archipelago played a far larger role in forming his ideas than did Darwin's brief visit to the Galápagos archipelago in shaping Darwin's. Wallace termed his years in the Malay Archipelago the 'central and controlling incident' of his life. Wallace's name is associated with the two most striking biogeographic features of the archipelago, termed Wallace's Line and Wallacea; the former is the most famous single feature of world biogeography.

Wallace attempted to land on Kofiau from a sailing canoe on 21 June 1860, but unfavourable winds drove him past the island (Wallace 1869: 519, where he refers to Kofiau by the name of Poppa). Hence it was reserved for another collector seven years later to bring ornithological fame to Kofiau by discovering there a beautiful endemic species of paradise kingfisher. Subsequent collectors on Kofiau also obtained an endemic species of monarch flycatcher and three endemic bird subspecies. However, those previous ornithological visitors only collected specimens and reported no field observations. As a result, Kofiau has been ornithologically the most under-surveyed significant island of the Papuan Region. Our paper is based on three visits to Kofiau, in 1986, 2002 and 2007. We increased the number of

bird species known for Kofiau from 29 to 78 species, and we provide the first field information on Kofiau's five avian endemics and other birds.

As background, it is useful to remind ourselves of the differences between three biogeographic lines: Wallace's Line, Lydekker's Line and Weber's Line (see Fig. 1). Wallace's Line was named for Wallace by T. H. Huxley in 1868. To Wallace, it signified both a biogeographic and a geological divide. He noted that it is of biogeographic importance, because the line marks the eastern limit of the rich tropical continental Asian fauna. But Wallace recognised that the line is also geological: it marks the eastern limit of the shallow Asian continental shelf (termed the Sunda Shelf), such that islands west of the line, of which the largest are Bali, Java, Borneo and Sumatra, were (as we now know) part of the Asian mainland during Pleistocene times of low sea level. That second (geological) significance of Wallace's Line explains its first (biogeographic) significance: Asian animals that have difficulty crossing salt water (such as most non-volant mammals except rodents, almost all strictly freshwater fish, and many birds) were able to spread east during the Pleistocene to Bali and Borneo because those islands were then part of the Asian mainland, but could not cross beyond the Asian shelf limit across the permanent deep saltwater gap between Bali and Lombok.

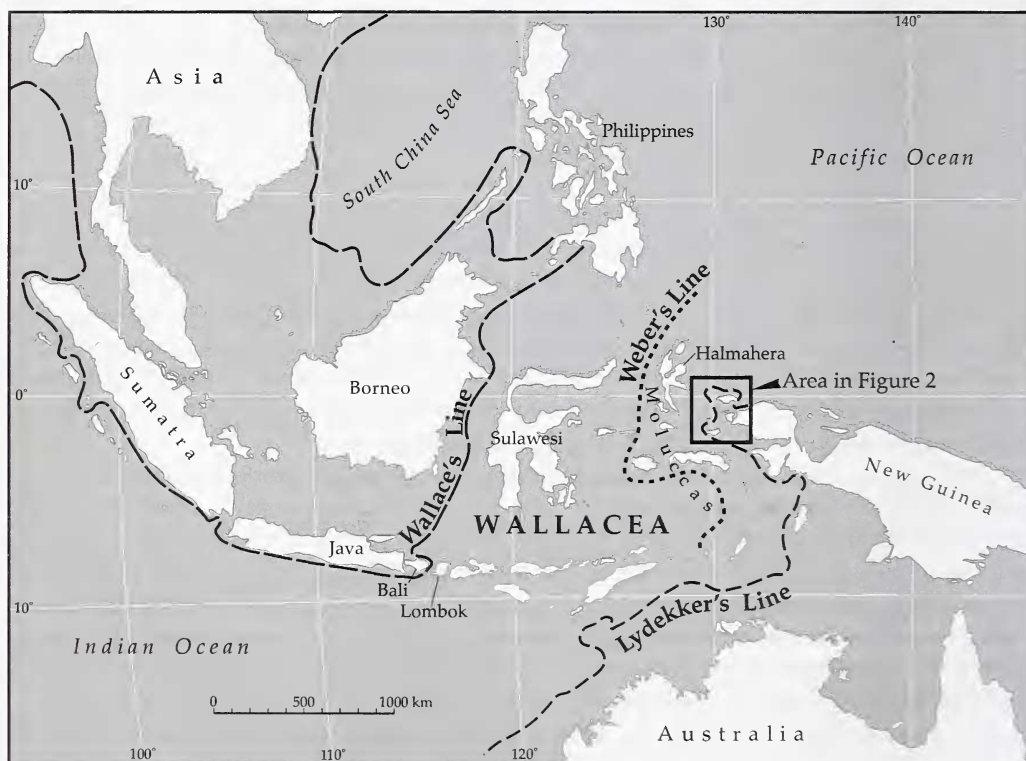


Figure 1. The tropical island region that Wallace termed the Malay Archipelago, extending from the South-East Asian continent in the west to New Guinea and Australia in the east. The dashed lines indicate the edges of the Asian and the New Guinea / Australian continental shelves at the 200-m ocean depth contours. Hence the dashed lines also indicate the margins of the Asian and the combined New Guinea / Australian continents at Pleistocene times of low sea level, when sea level was 150–200 m below the present. Wallacea is the island region between those shelf limits, consisting of islands with no recent connection to either continent. See text for discussion of Wallace's, Weber's and Lydekker's Lines.

The second line, termed Lydekker's Line, is the eastern equivalent of Wallace's Line. Whereas Wallace's Line marks the eastern limit of the Asian shelf and of the continental Asian fauna, Lydekker's Line forms the western limit of the Australian/New Guinea shelf (termed the Sahul Shelf) and of the continental Australo-Papuan fauna. (Australia and New Guinea were joined in a single continent at Pleistocene times of low sea level.)

Wallace's Line and Lydekker's Line both correspond to real geological features with biogeographic consequences. In contrast, the third line, termed Weber's Line, is defined purely biogeographically and has no geological counterpart. Wallace mistakenly believed that Wallace's Line marked the boundary between the Oriental biogeographic region and the Australian (or Australo-Papuan) biogeographic region. In fact, when subsequent authors calculated the decrease in the proportions of Oriental species and the increase in proportions of Australo-Papuan species as one proceeds east through the Indonesian island chains from Wallace's Line toward Lydekker's Line, it turned out that island faunas remain predominantly Oriental for at least 800 km east of Wallace's Line. Hence modern biogeographers often consider the Oriental Region proper to extend east only to Wallace's Line, the Australo-Papuan region proper to extend west only to Lydekker's Line, and the island zone between those two lines to represent a transition zone termed Wallacea (see Fig. 1). The fauna of Wallacea includes many insular endemics, but Wallacea is poorer in species than either of the two continental regions flanking it, because it consists of so-called oceanic islands that have had no recent connection to either continent and that in consequence have been populated only by species capable of crossing salt water. Weber's line of faunal balance marks the approximate line through Wallacea at which faunas are 50% Oriental and 50% Australian.

This brief account omits many interesting complications that are discussed by Darlington (1957) and Mayr (1976), and some of which we shall consider in this paper. For our purposes here, we merely note at this stage that Kofiau does not lie on the Sahul Shelf but 30 km west of it (Fig. 2), and has had no recent connection to New Guinea. Hence its fauna must have arrived over water.

## Description of Kofiau

Kofiau is centred on 01°11'S, 129°50'E, and has an area of 144 km<sup>2</sup> (Fig. 2). The nearest point of the New Guinea mainland is presently 110 km to the east; Misool, a species-rich island lying on the Sahul Shelf and hence supporting much of the New Guinea lowland avifauna, is 58 km to the south. The nearest large island of Wallacea is the Moluccan island of Halmahera 138 km to the west.

Most of Kofiau is flat and low, but there are two small hills, one (Mata Hill) of 288 m near the north-west coast, and the other of 255 m near the west end. A small lake (Lake Enyar Dore) of c.10 ha lies 1 km east of Mata Hill. Off the north-west, west and south-west coasts are c.20 smaller islets, all within 1–2 km of Kofiau or of each other and virtually constituting extensions of Kofiau. Kofiau's three villages, Tolobi, Dibalal and Deer, all lie on three of those islets off the west and north-west coasts, but their main garden areas lie directly opposite those islets on Kofiau itself.

At the time of our visits, most of Kofiau still supported forests up to 35 m tall. Gardens, coconut plantations and second growth (often with remnant tall trees) occur especially near the villages, along the north-west coast and on the offshore islets. There is much mangrove on western Kofiau and on the west and south-west islets. The eastern half of Kofiau has many exposed coral blocks and is largely unused by people.



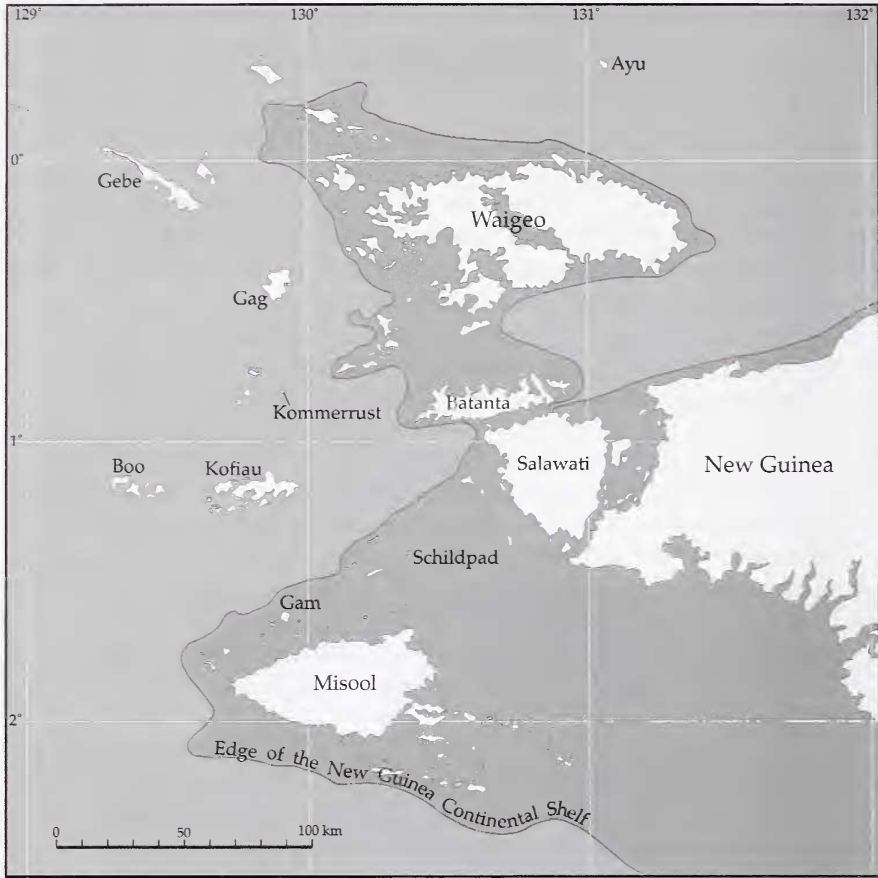


Figure 2. The Western Papuan Islands, with the New Guinea continental shelf lying within the 200-m ocean depth contour denoted in darker grey. Note that Kofiau, Gag and Gebe lie off the shelf and have had no recent land connections to the New Guinea mainland, whereas Salawati, Misool, and possibly Batanta and Waigeo lie on the shelf and were part of New Guinea at Pleistocene times of low sea level.

## Surveys of Kofiau

*Previous surveys.*—Five ornithological collections were made on Kofiau prior to our surveys. H. A. Bernstein visited on an unknown date in 1863–65. The sole evidence of his visit is a specimen of the cuckoo *Cacomantis variolosus* examined by Salvadori (1880–82, vol. 1: 337). David Hokum, an assistant of the collector D. S. Hoedt, visited around 26 July 1867 and obtained five species, including the types of the Kofiau endemics *Tanysiptera ellioti* and *Rhipidura rufiventris vidua*. In a 30-hour visit on 30–31 July 1875, cut short by the deaths of three of his hunters, Odoardo Beccari obtained 40 skins of 18 species (Beccari 1875). Hunters for the trader A. A. Bruijn obtained two species (the same two of which Hokum had collected the types) in August 1875. Finally, Jusup Khakiaj collected 21 species between 25 April and 9 May 1955 (Ripley 1959).

*Our surveys.*—We carried out three surveys: JD & KDB on 6–8 February 1986, and IM & LW on 10–23 July 2002 and 19–23 April 2007. All three surveys used base camps near Deer village and visited Lake Enyar Dore. The first and third surveys each twice ascended Mata Hill. JD & KDB used a boat to visit all three villages, both the west and east ends of Kofiau,



and three of the western islets without villages (Djailolo, Myotkoya and Monkesi). In addition to visual observations, we used tape recorders to capture vocalisations, and later listened to our recordings in order to detect species that might have escaped our notice in the field.

### Species recorded for Kofiau

Of the 29 species previously collected on Kofiau, we observed all but two: the wintering Pacific Golden Plover *Pluvialis fulva*, of which Khakiaj collected one specimen; and Island Whistler *Pachycephala phaionota*, a specialist of small islets, of which Khakiaj collected two without specifying whether he took them on Kofiau itself or on one of its fringing islets.

To those 29 previously recorded species, we added 49 new records, bringing Kofiau's presently known avifauna to 78 species. Of them, two are seabirds (species nos. 2 and 26 in Table 1), eight or nine are Palearctic winter visitors (nos. 21–25, 54, 56, 57 and possibly 16), two to five are Australian winter visitors (nos. 49, 51, and possibly 44, 52 and 59), and the remaining 62 are presumably resident land and freshwater species. Among the 62 species, several of which we observed only one or a few individuals could prove to be non-breeding vagrants (e.g., nos. 3–6, 9 and 65), whilst conversely it is possible that records of Channel-billed Cuckoo *Scythrops novaehollandiae* (no. 44) refer to breeders rather than to winter visitors as usually assumed.

What additional species might still be found on Kofiau? One indication is provided by the avifaunas of Gag and Gebe, two islands that resemble Kofiau in being of similar size and lying in deep water off the Sahul Shelf (i.e., beyond Lydekker's Line), at distances of 72 and 108 km respectively north of Kofiau (Fig. 2). The avifauna of Gag, as known from collections by Johnstone (2006) and colleagues in 1997, our observations (JD & KDB) in 1986, and a few specimens collected in the 1860s by Bernstein and by Wallace, comprises 46 resident land and freshwater species, nine seabirds, seven Palearctic and six Australian winter visitors, and two vagrants. The avifauna of Gebe, as known from five collectors (mainly Bernstein) and summarised by Mees (1972), comprises 39 resident land and freshwater species, and four Palearctic and two Australian winter visitors. Most species on both islands—49 of the 70 species of Gag, and 33 of the 45 species of Gebe—have been recorded on Kofiau. Unrecorded from Kofiau are three possible or presumed residents (Beach Kingfisher *Halcyon saurophaga*, Grey Whistler *Pachycephala griseiceps* and White-breasted Woodswallow *Artamus leucorhynchus*) and one winter visitor (Grey-streaked Flycatcher *Muscicapa griseictica*) of both Gag and Gebe; four possible or presumed residents (Beach Stone-curlew *Esacus magnirostris*, Stephan's Emerald Dove *Chalcophaps stephani*, Collared Kingfisher *Halcyon chloris* and Spot-winged Monarch *Monarcha guttulus*), two presumed vagrants (Cattle Egret *Bubulcus ibis* and Gurney's Eagle *Aquila gurneyi*), four presumed winter visitors (Great Egret *Egretta alba*, Chinese Sparrowhawk *Accipiter soloensis*, Ruddy Turnstone *Arenaria interpres* and Tree Martin *Hirundo nigricans*), and seven marine species (Great Frigatebird *Fregata minor*, Red-footed Booby *Sula sula* and five tern species) of just Gag; and six possible or presumed residents (Black Bittern *Ixobrychus flavicollis*, Moustached Treeswift *Hemiprocne mystacea*, Red-bellied Pitta *Pitta erythrogaster*, Olive Honeyeater *Lichmera argentea*, Hooded Butcherbird *Cracticus cassicus* and supposedly Glossy-mantled Manucode *Manucodia ater* based on a specimen of dubious provenance) and two winter visitors (Oriental Cuckoo *Cuculus saturatus* and Gray's Grasshopper Warbler *Locustella fasciolata*) of just Gebe. Some of these (e.g., *Ixobrychus flavicollis*) are cryptic and could be resident but overlooked on Kofiau; a few (e.g., *Halcyon chloris* and *Cracticus cassicus*) are so

TABLE 1  
Species recorded for Kofiau Island

Scientific nomenclature generally follows Beehler *et al.* (1986) for all species recorded from the Papuan Region, and follows Coates & Bishop (1997) for all species recorded from Wallacea but not from the Papuan Region, with updates to specific names and some taxonomy taken from Gill & Wright (2006). English names are taken in their entirety from Gill & Wright (2006). Subspecific identities of populations for which Kofiau specimens have been collected and studied (e.g., *Megapodius f. freycinet*) are taken from the taxonomic literature, especially Salvadori (1880–82), Mayr (1941) and Ripley (1959). For populations known only from sight records without specimens, we give a subspecies name if the same subspecies occupies the Moluccas to the west and the Western Papuan Islands and western New Guinea to the east, hence presumably also Kofiau (e.g., *Tachybaptus ruficollis tricolor*); or, in a few cases, if we were able to observe subspecific characters in the field (e.g., *Falco m. moluccensis*). Otherwise, we use 'subsp.' to mean that subspecific identity is indeterminate (e.g., *Aviceda subcristata*). Lack of any notation for subspecies means that the species is monotypic (e.g., *Fregata ariel*). \* = Kofiau endemic subspecies. \*\* = Kofiau endemic species.

'Status': res = presumed resident, res? = possibly resident, wva = winter visitor from Australia, wvp = winter visitor from the Palaearctic.

'Habitat': L = lake, C = coastal, S = sea >100 m from the coast, F1 = primary forest, F2 = secondary forest, old gardens and sago swamp, M = mangrove, T = non-forest habitats with trees (gardens, coconut plantations, forest edge), O = open habitats and villages, A = aerial.

'Ab.' (abundance): 4 = Kofiau's nine most abundant species, 3 = common, 2 = in low numbers but encountered repeatedly, 1 = just one or a few records.

'Col./Obs.': Be = Beccari, Bn = Bernstein, Br = Bruijn, D = Diamond & Bishop, H = Hokum, K = Khakiaj, M = Mauro & Wijaya.

'Distr.' (distribution): species present in the Moluccas = M, Kofiau = K, Western Papuan Islands = W (excluding the few species confined there to Kofiau, Gebe and/or Gag), and New Guinea = N. Underlinings denote shared subspecific affinities, as follows. Monotypic species receive no underlining (e.g., species 2, 13 . . . : MKWN, MKW, MK). Species known to be represented by the same subspecies where present in all of our letter-designated regions receive a continuous underlining (e.g., species 1, 3, 15 . . . : MKN, MKWN, MK, KWN, KW, KN). Species of which the Kofiau population is known to belong to the Moluccan subspecies, which is distinct from the Western Papuan Island / New Guinea subspecies, are designated MKWN or MKN (species 28, 58, 77). Conversely, species of which the Kofiau population is known to belong to the Western Papuan Island subspecies or to the subspecies shared by the Western Papuan Islands and New Guinea, distinct from the Moluccan population, are designated MKWN, MKW (species 19, 27, 31 . . . ). Finally, species for which the subspecific affinity of the Kofiau population is unknown have no underlining beneath the letter K, and either a single line beneath the letters M, W and N if those populations belong to the same subspecies (e.g., species 16, 36, 40, 45: MKN, KWN, MKW, MKWN), or single and double underlinings to distinguish different subspecies for the populations M, W and N (e.g., species 8, 34, 62: MKWN, MKW). For the three endemic subspecies of Kofiau (species 61, 63, 70), the letter K is not underlined, and different subspecific affinities of the other populations are indicated by single and double underlinings (e.g., KWN, MKWN).

#	English name	Scientific name	Status	Habitat	Ab.	Col./Obs.	Distri.
1	Little Grebe	<i>Tachybaptus ruficollis tricolor</i>	res	L	2	D, M	<u>MKN</u>
2	Lesser Frigatebird	<i>Fregata ariel</i>	res	S	2	D, M	<u>MKWN</u>
3	Little Pied Cormorant	<i>Phalacrocorax melanoleucos melanoleucos</i>	res?	C	1	M	<u>MKWN</u>
4	Great-billed Heron	<i>Ardea sumatrana sumatrana</i>	res?	C, M	1	D, M	<u>MKWN</u>
5	Yellow-billed Egret	<i>Egretta intermedia intermedia</i>	res?	L, C	1	M	<u>MKWN</u>
6	Little Egret	<i>Egretta garzetta nigripes</i>	res?	C	1	M	<u>MKWN</u>
7	Pacific Reef Heron	<i>Egretta sacra sacra</i>	res	C, M	2	D, M	<u>MKWN</u>
8	Striated Heron	<i>Ardeola striata subsp.</i>	res	M	2	D, K, M	<u>MKWN</u>
9	Rufous Night Heron	<i>Nycticorax caledonicus hilli</i>	res?	F2	1	M	<u>MKWN</u>
10	Osprey	<i>Pandion haliaetus melvillensis</i>	res	C	2	D, K, M	<u>MKWN</u>
11	Pacific Baza	<i>Aviceda subcristata subsp.</i>	res	T	1	D	<u>MKWN</u>
12	Brahminy Kite	<i>Haliastur indus girrenera?</i>	res	T	2	D, M	<u>MKWN</u>
13	White-bellied Sea Eagle	<i>Haliaeetus leucogaster</i>	res	C, S	2	D, M	<u>MKWN</u>
14	Grey Goshawk	<i>Accipiter novaehollandiae subsp.</i>	res	T	2	D, M	<u>MKWN</u>
15	Spotted Kestrel	<i>Falco moluccensis moluccensis</i>	res	T	1	M	<u>MK</u>
16	Peregrine Falcon	<i>Falco peregrinus subsp.</i>	wvp?	?	1	M	<u>MKN</u>
17	Spotted Whistling Duck	<i>Dendrocygna guttata</i>	res	C	1	M	<u>MKWN</u>
18	Raja Shelduck	<i>Tadorna radjah</i>	res	L, C	1	D, M	<u>MKWN</u>
19	Dusky Megapode	<i>Megapodius freycinet freycinet</i>	res	F1, F2	3	Be, D, K, M	<u>MKW</u>
20	Red-necked Crake	<i>Rallina tricolor tricolor</i>	res	F2	3	M	<u>KWN</u>
21	Pacific Golden Plover	<i>Pluvialis fulva</i>	wvp	C	1	K	<u>MKWN</u>
22	Whimbrel	<i>Numenius phaeopus variegatus</i>	wvp	C, M	1	D	<u>MKWN</u>
23	Grey-tailed Tattler	<i>Tringa brevipes</i>	wvp	C	1	M	<u>MKWN</u>

24	Common Sandpiper	<i>Tringa</i>	<i>hypoleucos</i>		wvp	C	1	D, M	<u>MKWN</u>
25	Red-necked Phalarope	<i>Phalaropus</i>	<i>lobatus</i>		wvp	S	2	D	<u>MKWN</u>
26	Swift Tern	<i>Sterna</i>	<i>bergii</i>	<i>cristata</i>	res	S	1	D	<u>MKWN</u>
27	Brown Cuckoo-Dove	<i>Macropygia</i>	<i>amboinensis</i>	<i>doreya</i>	res	F1, F2	3	Be, D, K, M	<u>MKWN</u>
28	Common Emerald Dove	<i>Chalcophaps</i>	<i>indica</i>		res	F2	2	Be, D, M	<u>MKN</u>
29	Nicobar Pigeon	<i>Caloenas</i>	<i>nicobarica</i>	<i>nicobarica</i>	res	F1, F2 ?	1	D, H	<u>MKWN</u>
30	White-bibbed Fruit Dove	<i>Ptilinopus</i>	<i>rivoli</i>	<i>prasinorrhous</i>	res	F1, F2, M	3	Be, D, M	<u>MKWN</u>
31	Claret-breasted Fruit Dove	<i>Ptilinopus</i>	<i>viridis</i>	<i>pectoralis</i>	res	F1, F2, M	3	Be, D, M	<u>MKWN</u>
32	Spice Imperial Pigeon	<i>Ducula</i>	<i>myristicivora</i>	<i>myristicivora</i>	res	F1, F2, M	1	D, M	<u>KW</u>
33	Spectacled Imperial Pigeon	<i>Ducula</i>	<i>perspicillata</i>	subsp.	res	F1, F2, M	4	D, M	<u>MK</u>
34	Violet-necked Lory	<i>Eos</i>	<i>squamata</i>	subsp.	res	F2, T	4	D, M	<u>MKW</u>
35	Red-flanked Lorikeet	<i>Charmosyna</i>	<i>placentis</i>	subsp.	res	F2	1	D, M	<u>MKWN</u>
36	Yellow-crested Cockatoo	<i>Cacatua</i>	<i>galerita</i>	subsp.	res	F1, F2	3	D, M	<u>KWN</u>
37	Yellow-capped Pygmy Parrot	<i>Micropsitta</i>	<i>keiensis</i>	<i>chloroxantha</i>	res	F1, F2	4	Be, D, M	<u>MKWN</u>
38	Double-eyed Fig Parrot	<i>Cyclopsitta</i>	<i>diophtalma</i>	<i>diophtalma</i>	res	F1, F2, M	1	D, H	<u>KWN</u>
39	Red-cheeked Parrot	<i>Geoffroyus</i>	<i>geoffroyi</i>	<i>pucherani</i>	res	F2, T	2	D, H, K, M	<u>MKWN</u>
40	Great-billed Parrot	<i>Tanygnathus</i>	<i>megalorynchos</i>	subsp.	res	F2	2	D, M	<u>MKW</u>
41	Eclectus Parrot	<i>Eclectus</i>	<i>roratus</i>	subsp.	res	F1, F2, T	3	D, M	<u>MKWN</u>
42	Brush Cuckoo	<i>Cacomantis</i>	<i>variolosus</i>	<i>infaustus</i>	res	F2	3	Bn, D, K, M	<u>MKWN</u>
43	Little Bronze Cuckoo	<i>Chrysococcyx</i>	<i>minutillus</i>	subsp.	res	F2	3	D, M	<u>MKWN</u>
44	Channel-billed Cuckoo	<i>Scythrops</i>	<i>novaehollandiae</i>		wva?	F2	2	D, M	<u>MKWN</u>
45	Large-tailed Nightjar	<i>Caprimulgus</i>	<i>macrurus</i>	subsp.	res	T	3	M	<u>MKWN</u>
46	Uniform Swiftlet	<i>Collocalia</i>	<i>vanikorensis</i>	subsp.	res	A	4	D, M	<u>MKWN</u>
47	Glossy Swiftlet	<i>Collocalia</i>	<i>esculenta</i>	subsp.	res	A	3	D, M	<u>MKWN</u>
48	Kofiau Paradise Kingfisher	<i>Tanysiptera</i>	<i>elliotti</i> **		res	F1, F2	4	Be, Br, D, H, K, M	<u>K</u>
49	Sacred Kingfisher	<i>Halcyon</i>	<i>sancta</i>	<i>sancta</i>	wva	T	3	Be, K, M	<u>MKWN</u>
50	Little Kingfisher	<i>Alcedo</i>	<i>pusilla</i>	<i>pusilla</i>	res	L	1	Be, D	<u>MKWN</u>
51	Rainbow Bee-eater	<i>Merops</i>	<i>ornatus</i>		wva	T	3	K, M	<u>MKWN</u>
52	Oriental Dollarbird	<i>Eurystomus</i>	<i>orientalis</i>	subsp.	wva?	T	3	M	<u>MKWN</u>
53	Hooded Pitta	<i>Pitta</i>	<i>sordida</i>	<i>novaeguineae</i>	res	F1, F2	3	Be, D, K, M	<u>KWN</u>
54	Barn Swallow	<i>Hirundo</i>	<i>rustica</i>	<i>gutturalis</i>	wvp	A	3	D, M	<u>MKWN</u>
55	Pacific Swallow	<i>Hirundo</i>	<i>tahitica</i>	subsp.	res	A	2	M	<u>MKWN</u>
56	Red-rumped Swallow	<i>Hirundo</i>	<i>daurica</i>	subsp.	wvp	A	2	M	<u>KN</u>
57	Yellow Wagtail	<i>Motacilla</i>	<i>flava</i>	<i>simillima</i>	wvp	O	1	D, M	<u>MKWN</u>
58	White-bellied Cuckooshrike	<i>Coracina</i>	<i>papuensis</i>	<i>melanolora</i>	res	T, M	2	Be, D, K, M	<u>MKWN</u>
59	Common Cicadabird	<i>Coracina</i>	<i>tenuirostris</i>	<i>muellerii</i>	wva?	T	1	Be, M	<u>MKWN</u>
60	Black-browed Triller	<i>Lalage</i>	<i>atrovirens</i>	subsp.	res	F2, T	3	D, M	<u>KWN</u>
61	Large-billed Gerygone	<i>Gerygone</i>	<i>magnirostris</i>	<i>occasa</i> *	res	F1, F2, M	4	D, K, M	<u>KWN</u>
62	Rufous Fantail	<i>Rhipidura</i>	<i>rufifrons</i>	subsp.	res	F2	1	D	<u>MKWN</u>
63	Northern Fantail	<i>Rhipidura</i>	<i>rufiventris</i>	<i>vidua</i> *	res	F1, F2	4	Be, Br, D, H, K, M	<u>MKWN</u>
64	Willie Wagtail	<i>Rhipidura</i>	<i>leucophrys</i>	<i>melaleuca</i>	res	T, M	2	D, M	<u>MKWN</u>
65	Island Monarch	<i>Monarcha</i>	<i>cinerascens</i>	subsp.	res?	T	1	M	<u>MKWN</u>
66	Kofiau Monarch	<i>Monarcha</i>	<i>julianae</i> **		res	F1, F2	4	Be, D, K, M	<u>K</u>
67	Shining Flycatcher	<i>Myiagra</i>	<i>alecto</i>	<i>chalybeocephalus</i>	res	F2, M, T	3	Be, D, K, M	<u>MKWN</u>
68	Island Whistler	<i>Pachycephala</i>	<i>phaionota</i>		res	?	1	K	<u>MKW</u>
69	Olive-crowned Flowerpecker	<i>Dicaeum</i>	<i>pectorale</i>	subsp.	res	F1, F2, M	3	D, M	<u>KWN</u>
70	Black Sunbird	<i>Nectarinia</i>	<i>aspasia</i>	<i>mariae</i> *	res	F2	4	Be, D, K, M	<u>MKWN</u>
71	Olive-backed Sunbird	<i>Nectarinia</i>	<i>jugularis</i>	<i>frenata</i>	res	F2, T, M	3	D, K, M	<u>MKWN</u>
72	Papuan Friarbird	<i>Philemon</i>	<i>novaeguineae</i>	<i>novaeguineae</i>	res	F2, T, M	2	Be, D, M	<u>KWN</u>
73	Black-faced Munia	<i>Lonchura</i>	<i>molucca</i>		res	O	1	M	<u>MK</u>
74	Eurasian Tree Sparrow	<i>Passer</i>	<i>montanus</i>	<i>malaccensis</i>	res	O	2	M	<u>MKWN</u>
75	Moluccan Starling	<i>Aplonis</i>	<i>mysolensis</i>	subsp.	res	T	1	D	<u>MKW</u>
76	Metallic Starling	<i>Aplonis</i>	<i>metallica</i>	<i>metallica</i>	res	F1, F2, T	3	D, M	<u>MKWN</u>
77	Hair-crested Drongo	<i>Dicrurus</i>	<i>hottentottus</i>	<i>atrocaeruleus</i>	res	F1, F2	2	Be, D, K, M	<u>MKWN</u>
78	Torresian Crow	<i>Corvus</i>	<i>orru</i>	<i>orru</i>	res	T, M	2	D, M	<u>MKWN</u>



common, vocal and conspicuous where present that our failure to observe them on Kofiau probably means that they really are absent; and others (e.g., *Bubulcus ibis* and *Hemiprocne mystacea*) may just have been vagrants on Gag or Gebe and could equally well turn up on Kofiau. Notable and probably real on all three islands is the absence or paucity of honeyeaters, usually common elsewhere in the Papuan region: on Kofiau we, Khakiaj, and Beccari found only Papuan Friarbird *Philemon novaeguineae*; Johnstone, we, Wallace, and Bernstein found no honeyeater on Gag; and the sole honeyeater known from Gebe is the small-island specialist *Lichmera argentea*, collected there only by Bernstein, possibly as a vagrant.

## Continental and oceanic island species on Kofiau

In passing from Java and Bali across Wallace's Line to Lombok, one leaves behind flightless mammals unable to fly, swim or raft across broad water gaps—such as rhinoceroses, tigers, leopards and gibbons. More surprisingly, because most birds can fly, Wallace was struck by the fact that Wallace's Line also serves as a barrier for many families and genera of birds, including pheasants, barbets, trogons, broadbills, leafbirds, and most genera of woodpeckers and babblers. These and many other tropical birds, whilst physically capable of flying across water, are behaviourally very reluctant to do so (Diamond 1981). Hence their insular distributions are restricted to continental islands that had Pleistocene connections to the Asian mainland, and that are sufficiently large to support sizeable populations able to persist in isolation since the end of the Pleistocene.

Corresponding to Wallace's observation that Wallace's Line at the edge of the Sunda Shelf marks the distributional limit for Oriental bird species unwilling or unable to fly across water, Lydekker's Line at the edge of the Sahul shelf marks the distributional limit for New Guinea species similarly unwilling or unable to cross water. Previous studies had identified 134 species of New Guinea lowland birds known from New Guinea's six large continental islands (Aru, Batanta, Misool, Salawati, Waigeo and Yapen) on the Sahul Shelf and connected to New Guinea during the Pleistocene<sup>1</sup>, whilst absent from all oceanic islands near New Guinea but beyond the shelf and lacking Pleistocene connections to New Guinea (e.g., Biak, Gebe, Gag, Karkar, Kei, Manam, Misima, New Britain, Numfor and Woodlark) (Diamond 1972a). Those species include all bowerbirds, all New Guinea birds of paradise except *Manucodia* and *Paradisaea*, many genera with three or more New Guinea lowland species (e.g., *Talegalla*, *Chalcopsitta*, *Psittaculirostris*, *Dacelo*, *Sericornis*, *Pitohui* and *Pycnopygius*), plus some of the commonest species of New Guinea lowland forest (e.g., Beautiful Fruit Dove *Ptilinopus pulchellus*, Blue Jewel-babbler *Eupetes caeruleus*, Rusty Mouse Warbler *Crateroscelis murina*, Yellow-bellied Gerygone *Gerygone chrysogaster*, Frilled Monarch *Arses telescopthalmus*, Brown Oriole *Oriolus szalay*, Green-crowned Longbill *Toxorhamphus novaeguineae* and Long-billed Honeyeater *Melilestes megarhynchus*).

<sup>1</sup> It is uncertain whether Batanta and Waigeo actually lie on the Sahul Shelf, or on a separate plate that has remained separated from the shelf by up to a few kilometers. The sea between Batanta and Waigeo is so shallow that those islands were undoubtedly connected to each other during the Pleistocene, and similarly Misool and Salawati were undoubtedly connected to each other and to New Guinea. Batanta is today separated from Salawati by the narrow Sagewin Strait, whose deepest portion is slightly more than 200 m deep. If that were also true throughout the Pleistocene, Batanta / Waigeo would have been separate then from Salawati / Misool / New Guinea, because Pleistocene drops in sea level were by slightly less than 200 m. However, in this tectonically active region one cannot be certain that the depth of Sagewin Strait has remained constant. In their proportions of non-water-crossing bird species, the avifaunas of Batanta and Waigeo are similar to those of Misool and Salawati, suggesting that a Pleistocene water gap at the Sagewin Strait, if it persisted at all, was extremely narrow.

This list of 134 lowland species present on one or more of New Guinea's continental islands but absent from all of its oceanic islands was drawn up 37 years ago, at a time when the avifauna of Kofiau was very incompletely known. Now that Kofiau's avifauna is better known, we re-examined it from this perspective. It turns out that all of Kofiau's species are ones already identified as water-crossers because of their presence on other oceanic islands of the New Guinea region.

That is, the avifaunas of New Guinea's oceanic islands, including Kofiau, are all drawn from a subset of the New Guinea avifauna characterised by ability and willingness to colonise across water. That accounts at least in part for the above-mentioned similarities between the avifaunas of Kofiau, Gag and Gebe: that Kofiau's 62 resident land and fresh-water species include 85% of Gag's resident species and 77% of Gebe's resident species. One could object that these three islands are within 108 km of each other, and that their avifaunal similarities may thus be partly due to colonisation between these three. Hence a stronger test is provided by comparing Kofiau's avifauna with that of the Bismarck Archipelago (Mayr & Diamond 2001) east of New Guinea, c.2,000 km east of Kofiau, and separated from Kofiau by the entire length of New Guinea. There can hardly have been direct colonisations between the Bismarcks and Kofiau. Because the Bismarck Archipelago includes many islands much larger than Kofiau, the Bismarck resident land and freshwater avifauna (151 species) is richer than Kofiau's (62 species), though much poorer than New Guinea's (432 species). (In these calculations we do not separately count different allospecies of the same superspecies: see Mayr & Diamond 2001.) Of Kofiau's 62 species, eight have no access to the Bismarcks because they are confined to western New Guinea and / or Wallacea and absent from the eastern part of New Guinea facing the Bismarcks (species nos. 15, 33, 34, 40, 68 and 73–75 of Table 1). That leaves 54 Kofiau species with access to the Bismarcks, of which 45 (i.e., 85%) actually occur in the Bismarcks, and only nine are absent (species nos. 4, 18, 28, 38, 39, 43, 48, 61 and 66 of Table 1). This similarity between the Kofiau and Bismarck avifaunas, despite their independent origins, mostly from New Guinea, arose convergently because both avifaunas were founded via over-water colonisation by a vagile subset of New Guinea's rich avifauna.

## Supertramps

In the Papuan Region and other tropical regions with many islands, some bird and bat species termed supertramps are confined to species-poor, small and / or remote islands and are absent from species-rich, large and / or central islands except as vagrants (Diamond 1972b). These species have especially high over-water colonisation rates, enabling them to maintain populations (through frequent recolonisations) on islets too small to support self-sustaining populations in isolation, and also enabling them to be among the first species to colonise islands defaunated by volcanic eruptions. Supertramp vagrants reach large species-rich islands but are competitively excluded by established species, except as occasional individuals along the coast.

Which species can be considered supertramps in the Western Papuan Islands? Ornithological visits to five isolated islets of <6 km<sup>2</sup> in that region have been reported: Ayu north-east of Waigeo, visited by Khakiaj on 1 September 1955 (Ripley 1959); Gam north of Misool, visited by JD & KDB on 5 February 1986; Kommerrust north of Kofiau, visited by JD & KDB on 8 February 1986; Little Boo west of Kofiau, visited by IM & LW on 23 April 2007; and Schildpad north-east of Misool, visited by Ripley and other members of the Denison-Crockett Expedition on 19–23 October 1937 (Mayr & Meyer de Schauensee 1939) (see Fig. 2). Collectively, these islets support nine species that approximate to the above def-

initiation of supertramps (numbers in parentheses indicate on how many of the five islets each species has been recorded): White-bibbed Fruit Dove *Ptilinopus rivoli prasinorrhous* (3), Spice Imperial Pigeon *Ducula myristicivora* (2), Violet-necked Lory *Eos squamata* (5), Rufous Fantail *Rhipidura rufifrons* (2), *Pachycephala phaionota* (3), Lemon-bellied White-eye *Zosterops chloris* (1), *Lichmera argenteauris* (3), Varied Honeyeater *Lichenostomus versicolor* (1) and Moluccan Starling *Aplonis mysolensis* (3). (We add the subspecies name to *P. rivoli*, to emphasise that this species includes a race *P. r. bellus* occupying the New Guinea mainland, as well as the supertramp race *P. r. prasinorrhous*). To this list of nine supertramps may be added a tenth, Island Monarch *Monarchia cinerascens*, not recorded on these five islets but apparently collected on islets off north-west Misool by Hoedt, and widespread on islets elsewhere in Wallacea, the Papuan Region and Northern Melanesia.

Of these five small isolated islets surveyed in the Western Papuan Islands, four were visited briefly, for a day or an hour. The only one surveyed more completely is Schildpad, on which Ripley and his team spent five days collecting. Schildpad yielded eight of the ten supertramps (all but *Monarchia cinerascens* and *Zosterops chloris*), and seven of the eight (all except *Eos squamata*) were noted by Ripley as common there or were collected by him as multiple specimens.

As for the occurrence of the supertramps on larger islands, the literature contains records of nine of these ten species (all except *Zosterops chloris*) by 19th-century collectors for all four of the large continental Western Papuan Islands (Batanta, Misool, Salawati and Waigeo, with areas of 453–3,155 km<sup>2</sup>). However, in our own surveys of these four islands our only encounters with these putative supertramps other than *Ducula myristicivora* were two records of *Lichenostomus versicolor* and one of *Aplonis mysolensis* from coastal villages of Misool and Waigeo. We suspect that the 19th-century records were mainly based on specimens similarly collected in coastal villages or on offshore islets, where 19th-century collectors made their bases and which they did not distinguish from the four larger islands themselves. A marginal case for inclusion as a supertramp is *Ducula myristicivora*, which we observed only on the coasts of Batanta and Waigeo where its congeners Pinon Imperial Pigeon *D. pinon* and Purple-tailed Imperial Pigeon *D. rufigaster* are abundant inland.

What about supertramp occurrences on Kofiau, Gebe, and Gag, which are intermediate in area (57–144 km<sup>2</sup>) between the small islets (<6 km<sup>2</sup>) with many supertramps and the large islands (453–3,155 km<sup>2</sup>) with few supertramps? The best surveyed of these three intermediate-sized islands is Kofiau, on which seven of the ten supertramps (all except *Lichmera argenteauris*, *Lichenostomus versicolor* and *Zosterops chloris*) have been recorded. Of those seven, we found two common (*Ptilinopus rivoli prasinorrhous* and *Eos squamata*), one scarce (*Ducula myristicivora*), and four represented by only one or two specimens, or observed by just one of the seven ornithological visitors to Kofiau. The scantier information for Gebe and Gag yields a similar conclusion, with one interesting difference. On Gebe (to judge from specimens: Mees 1972) and Gag (Johnstone's and our observations), *Ptilinopus rivoli prasinorrhous* and *Eos squamata* are common, as on Kofiau. *Lichmera argenteauris* and *Aplonis mysolensis* are known on Gebe only from one and two specimens respectively taken by a single collector. The interesting exception is that *Ducula myristicivora* is common on Gebe and Gag, but scarce on Kofiau. We attribute this difference to the fact that *Ducula myristicivora* faces competition from its abundant and similar-sized congener Spectacled Imperial Pigeon *D. perspicillata* on Kofiau, but from no congener or indeed any other large pigeon on Gebe and Gag.



## Biogeographic affinities of the Kofiau avifauna

Of Kofiau's 62 resident land and freshwater bird species, 35 yield no information about biogeographic affinities, because they are widespread in Wallacea (or at least in the Moluccas) as well as on New Guinea, and are either monotypic (four species: nos. 13, 17, 18, 68), or they occur as the same subspecies throughout the Moluccas and western New Guinea or the larger Western Papuan Islands (20 species: nos. 1, 3–7, 9, 10, 12, 29, 30, 40, 42, 45, 50, 64, 71, 74, 76, 78), or else occur in those two areas as different subspecies but the sub-specific identity of the Kofiau population is unknown (11 species: nos. 8, 11, 14, 35, 41, 43, 46, 47, 55, 62, 65).

Among the remaining 27 species that do permit conclusions, their directions of colonisation are suggested by several different lines of evidence. Five are Kofiau's endemic species and subspecies, of which two (species nos. 48 and 63) are most similar to their Moluccan relatives, and three (nos. 61, 66, and 70) are most similar to their Papuan relatives. Among ten species widespread in both the Papuan Region and in Wallacea or the Moluccas, occurring as different subspecies in those two regions, and with the Kofiau population sub-specifically identified, the Kofiau population belongs to the Papuan race in seven (nos. 19, 27, 31, 37, 39, 53, 67) and to the Wallacean race in three (nos. 28, 58, 77). Seven species (nos. 20, 32, 36, 38, 60, 69, 72) distributed over all or most of New Guinea extend west only to the Western Papuan Islands (including Kofiau), do not reach the Moluccas, hence can only have reached Kofiau from the direction of New Guinea. Conversely, five Wallacean or Moluccan species extend east only to Kofiau (no. 33), Kofiau and Gag (nos. 15, 73) or very sparingly to other Western Papuan Islands (nos. 34 and 75), hence surely or probably reached Kofiau from the direction of the Moluccas.

Thus, among those 27 informative species,  $3 + 7 + 7 = 17$  probably reached Kofiau from New Guinea, whilst  $2 + 3 + 5 = 10$  probably arrived from the Moluccas. Our conclusion of a Papuan predominance in the Kofiau avifauna confirms Mayr's (1941) and Ripley's (1959) conclusions deduced at a time when knowledge of Kofiau's avifauna was much less complete. This Papuan predominance is to be expected because New Guinea is much larger and much more species-rich, and slightly closer to Kofiau than are the Moluccas, and because the large Western Papuan island of Misool supporting a large fraction of the New Guinea mainland avifauna is even closer to Kofiau. The Papuan and Moluccan colonists of Kofiau also differ in their spread beyond Kofiau. One-third (six of 17) of the Papuan colonists have spread further west to colonise species-rich habitats of large Moluccan islands, whilst none of the Moluccan colonists spread east to New Guinea or even to the larger Western Papuan Islands.

## Wallacea's eastern boundary

Recent biogeographic discussions of the Malay Archipelago are in agreement that Wallacea is basically the archipelago of oceanic islands lying between the continental islands of the Sunda Shelf to west, and the continental islands of the Sahul Shelf to the east (e.g., Mayr 1976: 637–639, Darlington 1976: 462–472, White & Bruce 1986: 10, Coates & Bishop 1997: 9).

Almost no ambiguities arise in defining the western boundary of Wallacea, because the sea gap separating the easternmost large continental islands of the Sunda Shelf (Borneo and Bali) from the westernmost large oceanic islands of Wallacea (Sulawesi and Lombok) contains only a few, tiny, ornithologically insignificant islets. Hence one can straightforwardly take Wallacea's western boundary as the Sunda Shelf's edge (alias Wallace's Line); the geological and biogeographic lines are essentially the same. However, the situation is more

complex at Wallacea's eastern boundary, because the sea gap separating the westernmost large Papuan islands of the Sahul Shelf (Misool, Salawati and possibly Batanta and Waigeo) from the easternmost large oceanic islands of Wallacea (Halmahera and Seram) contains three intermediate-sized islands of ornithological significance (Kofiau, Gebe and Gag), all of which support endemic birds, including the two endemic allospecies of Kofiau. Should Wallacea's eastern boundary be drawn east or west of those three islands, so as to place them in Wallacea or in the Papuan Region respectively?

A simple solution consistent with the definition of Wallacea's western boundary would be to take its eastern boundary as the Sahul Shelf's edge (Lydekker's Line), thereby assigning Kofiau, Gebe and Gag to Wallacea. However, that geological definition does violence to biogeographic criteria, because the avifaunas of Kofiau, Gebe and Gag are predominantly Papuan rather than Wallacean. Hence all recent ornithological treatments (Mayr 1941, 1954, White & Bruce 1986, Coates & Bishop 1997) include Kofiau, Gebe and Gag within the Papuan Region and thus take Wallacea's eastern boundary to lie slightly west of the Sahul Shelf's edge. As Mayr (1976: 636) expressed it, '... these islands are so purely Papuan [now known to be an exaggeration] that it seems justified to be slightly inconsistent.' We agree.

### Conservation status

Kofiau's five endemics—its two endemic allospecies of kingfisher and monarch, and its three endemic subspecies of warbler, fantail and sunbird—are presently among Kofiau's most abundant species. All five are widespread in primary and secondary forests, except that the sunbird is only in secondary forests. The three endemic subspecies are not in immediate danger.

However, there are reasons to be concerned about the long-term survival of the two endemic allospecies, which we shall explain according to the threat categories and criteria used by IUCN (2001). These two allospecies are currently classified as Data Deficient (BirdLife International 2007). We propose that both be treated as Endangered based on IUCN criteria EN B1+2ab(iii) (IUCN 2001). Both species, on present knowledge, are confined to the island of Kofiau proper, an area of 144 km<sup>2</sup>. Even if they occurred on some satellites in the group, their Extent of Occurrence delineated by the minimum convex polygon spanning the entire group could never exceed 5,000 km<sup>2</sup> (IUCN criterion B1), and their Area of Occupancy at full saturation of the entire group at the IUCN 4 km<sup>2</sup> grid cell reference scale could never exceed 500 km<sup>2</sup> (criterion B2). The entire island of Kofiau can only be regarded as a single location with regard to applying IUCN qualifier a (<5 locations; qualifier a). Our observations show that, whilst both species persist in shaded, traditional subsistence gardens, they are commonest in closed-canopy secondary and primary forest. We also found circumstantial evidence that immatures of the kingfisher may depend entirely on tall closed-canopy forest during their early life stages (see below). Kofiau has been extensively selectively logged since the 1970s, and the infertile limestone substrates delay forest regeneration. Establishment of new subsistence gardens and cash-crop coconut groves by slash-and-burn methods, as well as small-scale timber extraction in the remaining patches of primary forest such as on Mata Hill, were all evident during our visits. We conservatively estimate that agricultural clearings increased by 30% along our trans-island transect during the five-year period spanning our 2002 and 2007 visits. The 4 km<sup>2</sup> IUCN reference scale is too coarse to trigger complete local extirpation and a reduction in Area of Occupancy (IUCN qualifier b(ii)) because some individuals are still likely to persist within the non-forest matrix at this scale. However, the general picture emerging is that of continuous internal degradation of remaining primary forest, conversion of secondary forest to

cash-crop coconut groves, and scaling-up of traditional subsistence gardens, and we believe that IUCN qualifier b(iii) is met. The future of Kofiau's endemic birds will require efforts to protect remaining tracts of primary forest in a consensus conservation area through participatory mapping with local communities and landowners.

### Annotated list of selected species

We comment here on Kofiau's five endemics, and on three Kofiau populations constituting first or second records for the Papuan Region.

#### SPOTTED KESTREL *Falco m. moluccensis*

The only other Papuan record of this widespread Wallacean non-forest species is from Gag, where JD & KDB observed at least three pairs in 1986 and Johnstone (2006) found individuals and pairs uncommonly in 1997. On Kofiau, in 2002 we (IM and LW) observed daily an adult pair with two volant but incessantly begging juveniles near a tall forest-edge tree with a cavity at 20 m pointed out to us as the nest hole. In 2007 we observed two individuals at separate locations 2.5 km from the 2002 nest site. In their heavily blackish-spotted underwing-coverts, and the adults' lack of pale greyish cheeks, the Kofiau birds resembled the Moluccan race *F. m. moluccensis* (as Johnstone also concluded for Gag birds) rather than *F. m. microbalius* of other Wallacean islands.

#### SPECTACLED IMPERIAL PIGEON *Ducula perspicillata* ssp.

This is the first record of this widespread Moluccan species for the Papuan Region. We found it abundant in the canopy of primary and secondary forests, and remnant trees in gardens, singly or in groups of up to 30, far outnumbering its congener *D. myristicivora*. Plumage seemed closer to that of *D. p. neglecta* of Seram than to *D. p. perspicillata* of the Northern Moluccas and Buru, but we noted the leg coloration as pale greyish, rather than purple (Salvadori 1880–82) or pinkish (Coates & Bishop 1997). We recorded three vocalisations: a far-carrying, descending series of c.7 hoarse notes, the first at a lower pitch than the second, similar to the call of Flourey Imperial Pigeon *D. pistrinaria* of the Papuan Region and Northern Melanesia; a soft, short, ascending *br-r-r*; and a low-pitched slow note that rises and then falls in pitch.

#### KOFIAU PARADISE KINGFISHER *Tanysiptera ellioti*

This beautiful endemic allospecies is abundant, tame and solitary in tall shaded primary and secondary forests, and (adults but not immatures) also in shaded gardens, perching at 1–12 m but not venturing higher into the canopy. It holds perches for as long as several minutes. In July 2002 we recorded immatures only from tall closed-canopy forests, with home ranges centred on then-dry forest pools or small streams, suggesting narrower ecological requirements in immatures than adults. Soft-part colours of adults: bill blood red, iris very dark, legs dull olive; of immatures: bill blood red, often with darker cutting edges and dark brownish markings along culmen, usually on the centre; iris very dark brown or greyish black, legs pale yellowish green, claws posteriorly dark horn or blackish and anteriorly yellowish beige. Name, in the Raja Ampat dialect of the Biak language spoken on Kofiau: Mampitasoi ('Mam' means 'bird').

We heard four vocalisations. The primary song is a soft, musical, ascending, accelerating, rapidly trilled series of notes lasting 1.5–2.0 seconds, similar to the song of Galatea Paradise Kingfisher *T. galatea* but more plaintive and shorter. Agitated individuals repeatedly gave a shortened version of the song. The call, given by individuals seen near the



ground, is a series of three identical soft, mournful, high-pitched, slow downslurs; in some cases each note is slightly upslurred at the end. Finally, on a few occasions we heard three loud unmusical downslurs with the quality of an adolescent boy whose voice is breaking.

### **LARGE-BILLED GERYGONE** *Gerygone magnirostris occasa*

Common in all wooded habitats from primary forest to mangrove, sago swamps and gardens with trees, at any height from the understorey to the canopy, and foraging alone by gleaning. That broad habitat range on Kofiau contrasts with the New Guinea mainland and with all four continental Western Papuan Islands (Batanta, Misool, Salawati and Waigeo), where several forest-dwelling congeners (Green-backed Gerygone *G. chloronota*, Yellow-bellied Gerygone *G. chrysogaster* and Fairy Gerygone *G. palpebrosa*) occur, and where we found *G. magnirostris* mainly restricted to mangrove and to riverine vegetation. Amongst New Guinea gerygones, this is the sole species to disperse across water to oceanic islands of the Papuan Region, including Biak, Karkar, Manam, Misima, Rossel and Tagula. We often heard the song, which is a light, fast, tinkling, repeated phrase similar in quality to the song of *G. chloronota*.

Ripley (1957) described this endemic subspecies from a single specimen on the strength of its 'being much more richly yellow on the abdomen, vent and undertail coverts' and exhibiting 'darker, or brownish olive upperparts' than geographically proximate forms. We did not detect those features of Kofiau birds compared to birds that we saw in the previous and following weeks on Batanta, Misool, Salawati and Waigeo. At the time of Ripley's description, the most recent specimens available for comparison from those islands were considerably older and possibly had undergone post-mortem colour changes through foxing. Hence the validity of this subspecies demands confirmation. We noted Kofiau birds in life as having a distinct white eye-ring, rufous face- and neck-sides, buffy flanks, and white throat and central belly.

### **NORTHERN FANTAIL** *Rhipidura rufiventris vidua*

Common and widespread in forest and wooded habitats, including second growth and coconut groves with scrub, from 1–25 m, foraging by long swoops and sallies and returning to the original perch. Seen alone or with Kofiau Monarch *Monarcha julianae*; aggressive towards Yellow-capped Pygmy Parrot *Micropsitta keiensis*, Shining Flycatcher *Myiagra alecto* and Black Sunbird *Nectarinia aspasia*. This dark, cleanly patterned endemic subspecies is closest to *R. r. obiensis* of Obi. The song is a descending weak series of 3–5 whistled notes, occasionally preceded and / or followed by several other notes of similar quality.

### **KOFIAU MONARCH** *Monarcha julianae*

Abundant in primary and secondary forest, at heights of 1–30 m. Often in pairs of two identical birds, occasionally followed by a Northern Fantail *Rhipidura rufiventris* sallying presumably for insects disturbed into flight by the *M. julianae*, which rarely sallies. Active and tame, often flicking its wings and tail. It forages within a tree rather than at the tips of branches, by hover-gleaning, quick short hops of 0.3–1.0 m along a branch, and working vertically up a tree or vine.

Its three types of vocalisations are similar to those of many other monarchs, and are especially similar to those of Spot-winged Monarch *M. guttulus* and Hooded Monarch *M. manadensis*: a weak, tremulous, high-pitched note repeated three times at intervals of two seconds; a short, dry, buzzy rasp or squawk; and a rapid series of squawks.

In life, presumed adults have the upperparts, wings, face and throat black, the posterior margin of the black throat rounded; white underparts, extending anteriorly onto the

sides of the throat to behind the eye; top of the head pearly grey; tail ventrally black at the base, tip and medially, with broad white outer margins; bill bluish, legs dull blue-grey, eye black. All adults observed closely in 2002 had tiny white elongated spots along the shafts of the outer greater wing-coverts, but no adults seen in 2007, and only one in 1986, had such spots.

With one exception, presumed non-adults had the crown, mantle and rump dull grey, wings and tail brown, belly white, breast orange, a dark ear patch and area around the eye, a pale spot in front of the eye, and tail margins of reduced extent and off-white. The sole exception was an individual, accompanied by an adult, which had the entire upperparts (including the crown) and wings brown, the tail's underside paler brown without any visible white, the underparts dirty white extending to behind the eye as in the adult, and a dark but not black face patch.

*M. julianae* is very similar to *M. guttulus* in plumage, size, vocalisations and behaviour. The main distinctions of adult *M. julianae* from *M. guttulus* are that its back and wings are black not grey, white spots on the upper wing-coverts are tiny or absent, and the black throat extends less far posteriorly onto the breast. On Kofiau we observed no *M. guttulus*; all adult pied monarchs observed were similar except for the above-mentioned occasional presence of tiny white spots on the upper wing-coverts.

In describing *M. julianae* as a new species, Ripley (1959) stated that it occurs sympatrically on Kofiau with *M. guttulus* on the basis of a monarch specimen collected there by Beccari in 1875 and held in the Museo Civico di Storia Naturale, Genoa. Salvadori (1880–82, vol. 2: 23) had identified the specimen as a *M. guttulus* not quite adult, and differing from other *M. guttulus* specimens in lacking white spots on the upper wing-coverts and with the black of the throat less extensive posteriorly. That description suggested *M. julianae*. Hence JD wrote Dr Carlo Violani (University of Pavia), who with great kindness described in detail, measured, photographed and compared with *M. guttulus* Beccari's single Kofiau



Figure 3. Adult Kofiau Monarch *Monarcha julianae* (Iwein Mauro); this monarch flycatcher is endemic to Kofiau.

specimen, and then sent Beccari's specimen to the American Museum of Natural History (AMNH), New York, where JD compared Beccari's specimen with Khakiaj's unique type specimen (adult) of *M. julianae* borrowed from Yale's Peabody Museum of Natural History, plus the extensive series of adult and young *M. guttulus* at AMNH.

These comparisons confirmed, in the adult *M. julianae* type, the distinctions of *M. julianae* from *M. guttulus* that we observed in the field. The only other apparent distinction worth mentioning is that the black bib of the *M. julianae* type is narrower and more diamond-shaped (as noted by Ripley 1959) than in life; that appears to be an artefact of the type's preparation. The Beccari specimen agrees with the *M. julianae* type and with our field observations in (compared to *M. guttulus*) the absence of white spots on the upper wing-coverts, reduced posterior extent of the black throat, closer approach of white on the throat-sides to the eye, and perhaps more extensive white distally on the undertail. Beccari's specimen differs from adult *M. julianae* mainly in that the primaries are grey-brown not black, the back is slate blue-grey not black, and the superciliary is mottled grey and black rather than clean black, which features led Salvadori to identify it as a subadult *M. guttulus*, and not to recognise it as an endemic taxon in 1875. The dorsal blue-grey and ventral white of Beccari's specimen suggest that it represents a more advanced plumage than the brown-backed orange-breasted non-adults that we observed. Evidently, Beccari's specimen is a not fully adult *M. julianae*, and there is thus no evidence for sympatry of *M. guttulus* and *M. julianae*.

In short, we conclude that *M. julianae* is an endemic allospecies occurring on Kofiau in allopatry, and belonging to the same superspecies as either *M. guttulus* or (as suggested by Ripley) *M. manadensis*. Filardi & Smith's (2005) molecular evidence suggests that the latter superspecies is polyphyletic. Considerations in favour of the relationship with *M. guttulus* rather than with *M. manadensis* are the white spots on the wing-coverts of many adults of *M. julianae* (similar to but smaller than the spots of *M. guttulus*); and the fact that *M. guttulus* is a successful island colonist present on 15 islands of the Papuan Region besides New Guinea itself (including four of the Western Papuan Islands), but that *M. manadensis* occurs on no island except New Guinea. These relationships warrant further study.

#### **BLACK SUNBIRD** *Nectarinia aspasia mariae*

Common in secondary forest, gardens and coconut groves, often feeding at coconut flowers, but absent from primary forest. Described by Ripley (1959), and accepted by Mees (1965), as an endemic subspecies closest to the nominate New Guinea race but differing somewhat in coloration.

#### **BLACK-FACED MUNIA** *Lonchura molucca*

Encountered only on our 2002 visit, when on several occasions we observed a group of two adults and five immatures in an old overgrown coastal garden with alternating grassland and low scrub, on the Kofiau mainland opposite Deer Island. Second record for the Papuan Region, where it was previously recorded by Johnstone (2006) from Gag.

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